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*Editor-in-Chief*  
**Dr James Cameron**

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## **StemConferences 2018**

### **Batch A**

Editor-in-Chief: **Dr James Cameron**

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## **PREFACE**

The StemConferences 2018 held on 10<sup>th</sup> – 12<sup>th</sup> January, 2018, at The University of Sydney, New South Wales, Australia.

Australia is a country and continent surrounded by the Indian and Pacific oceans. Its major cities – Sydney, Brisbane, Melbourne, Perth, Adelaide – are coastal. Its capital, Canberra, is inland. The country is known for its Sydney Opera House, the Great Barrier Reef, a vast interior desert wilderness called the Outback, and unique animal species like kangaroos and duck-billed platypuses. I welcome everyone to enjoy the rich natural movements of Australia.

StemConferences 2018 provides a chance for Academic and Industry professionals to discuss the recent progress in the area of Multiple. The outcome of the conference will trigger for the further related research and future technological improvement. This conference highlights the novel concepts and improvements related to the research and technology.

The technical committee consists of experts in the various course subfields helped to scrutinize the technical papers in various fields, support to maintain the quality level of the proceedings of conference which consist of the information of various advancements in the field of research and development globally and would act as a primary resource of researchers to gain knowledge in their relevant fields.

The constant support and encouragement from all the associated has helped a lot to conduct the conference and to publish the proceedings within a short span. I would like to express my deep appreciation and heartfelt thanks to the publishers team members. Without them, the proceedings could not have been completed in a successful manner. I would like to express my sincere thanks to our management, student friends and colleagues for their involvement, interest, enthusiasm to bring this proceeding of the conference in a successful way.

**Dr James Cameron,**

Editor in Chief,  
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# Identifying Technical Design Principles to Maximize the Reuse of Building Components: A Systematic Literature Review

Reza Forghani<sup>1</sup>, Willy Sher<sup>2</sup>, Sittimont Kanjanabootra<sup>3</sup>, Yuri Totoev<sup>4</sup>

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**Abstract:** It is necessary to preserve natural resources and to reduce the environmental impacts of construction and demolition (C&D) waste. Reusing building components helps to reduce impact on the environment and increases the efficiency of C&D activities in terms of energy and cost. The purpose of this paper is to identify the building design measures influencing the “reuse” of building components. A number of Technical Design Principles (TDPs) that influence the efficiency of reusing building components were identified through a systematic literature review. Thirty TDPs were identified from 34 studies published between 1996 and 2016. These TDPs can help to improve the practice of reusing building components as well as facilitate building deconstruction. This paper argues that the implementation of TDPs should maximize the reuse of building components if the parties involved have a mutual understanding of TDPs.



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# An Introspective Discussion on Integrated Rural-Urban Development in India

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**Abstract:** India is a vast country with an area of about 3.288 million Km<sup>2</sup> with a population of about 1.221 billion as per Census 2011 which included 0.37 billion urban population and 0.83 billion rural population. As compared to the previous census record of 2001, the urban population has increased 9.1% whereas the rural population has decreased by 9.0%. The Government of India, in various periods of times, have implemented various policies to curb the rural urban migration. The most common of these are: (i) Formation of National Capital Region (NCR), 1992; (ii) Provision of Urban Amenities to Rural Areas (PURA), 2003 and (iii) ‘Shyama Prasad Mukherji Rurban Mission’ (SPMRM), 2016. The present paper focuses on the aspects of these three schemes analysing the SPMRM scheme from a critic’s point of view and discusses about its future outcome.

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## Rural Development in India: An Historic Review

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**Abstract:** Rural India is undergoing a sweeping transformation. The dynamic forces of political, technological and socio-economic change in rural India are complex and have achieved importance. Rural development seems as a process of not only increasing the level of per capital income of rural mass but also improve the standard of living of the rural population measured by food and nutrition level, health, education, housing, recreation and security. According to World Bank (2005), rural development is the process of rural modernization and the process of establishing legal setup of the rural society leading to its evolution from traditional isolation to integration with the national economy. In this context, this paper discusses the rural development in India its need and changes from pre-independence to current time. It also discusses the programs and schemes of government. Many government and non-government organizations (NGOs) are working in this field from the starting of the last century. As twelfth five year plan is aimed to sustainable development of the nation and without rural development it is not possible task. Thus, it is required to have coordination among various Government agencies and other institutions engaged in rural development to provide optimal benefit to the grass-root level. It will also promote in reducing the rural-urban gap in terms of basic infrastructure facilities essential for 'Sustainable Development' of a settlement.



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## A Comparative Investigation of the Engineering Properties of Perlite Concrete Containing Petroleum and Bio-Polymer Aggregates

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**Abstract:** The main objectives of this study were to compare the mechanical and thermal properties of perlite concrete containing expanded polylactic acid (EPLA) and expanded polystyrene (EPS) and also the possibility of using biopolymers as a replacement for conventional petroleum polymer aggregate. Nine mixes using different mix proportions were prepared. The variables used in this study include polymer types, EPLA ratio, EPS ratio, perlite ratio and curing regimes. The engineering properties considered include workability, density, compressive strength, tensile strength, elastic modulus and thermal conductivity. The experimental results show that an increase in EPLA and EPS aggregate volume resulted in a significant reduction in engineering properties of concrete. Also, the EPLA beads were degraded and shrank in the alkaline environment of cement. The rate of degradation was increased in a moist environment. The alkaline reactivity of EPLA beads causes notable changes in thermal conductivity of concrete. A simple method was proposed for the mix design of ultra-lightweight concrete.

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## Management of Excavated Material in Infrastructure Construction - A Critical Review of Literature

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**Abstract:** The current rate of expansion of metropolitan areas requires the expansion of public transportation frame-works like metro, train, and tunnels. This expansion has also led to new residential and commercial buildings development. These developments have resulted in significant volumes of excavated, material and more will be produced. In this study, the current approach of handling excavated material in infrastructure construction has been investigating through a literature review. Furthermore, recent studies concerning the material management have been discussed to identify shortages in managing the material. It has been found that traditional materials handling approaches, based on transporting material to landfill, can be changed to a more environmentally responsible approach. This approach maximizes the reuse and recycling of the material and curbs landfill development. Forty-four studies, spanning the past 20 years, have been reviewed. One of the main findings of this study was a categorization of excavated soil to reuse. Many reports have been presented the classification suitable for their project. However, a comprehensive study should be performed to identify material classes based on characteristics of the excavated soil. Furthermore, there is a gap in knowledge for management of the contaminated soil which needs to be addressed. Finally, the dynamic nature of spoil supply chain makes has to be considered for a careful study so it can address suppliers and customer's requirements to increase reusing of the material.



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## BIM as A Pedagogical Tool for Teaching HVAC Systems to Architecture Students

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**Abstract:** Understanding the basics of Environmental Control Systems including HVAC systems is required in architectural curricula. One of the challenges of learning this subject is the non-familiarity of the students with the components of these systems and how the selection and installation of these components can impact the architecture of the building and its special experience. Such difficult interrelationships can be clarified using various techniques. One technique that the author experimented with is the use of a BIM tool. Yet, using the tool to achieve this purpose was a challenge in itself. The tool needs to be setup and its interface needs to be configured for a particular learning objective within a defined learning environment. This paper discusses the various techniques to achieving the learning of this required subject. It also shares the details of preparing and executing the experiment of using BIM hoping that other instructors make use of it and further build on it. A survey of the students who went through the experiment shows that a large majority believe that they learned the subject better through the BIM tool.

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## Accumulation of Time and Its Visualization Process of Korean Modern Architecture: Focused on the Case of Mapo Cultural Oil Depot, Seoul

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**Abstract:** This study analyses the interrelationships among the three elements: the structure of architecture, the form of design, and the flow of time. Especially in the case of renovation, the methodology of morphological design of structural change with time is a key part of architectural design. Korean architecture has carried out a variety of urban regeneration projects through the modern era. Among them, this study selects Mapo cultural oil depot in Seoul and analyses the universality and specificity of this case. There are a variety of existing variables, such as approaches, doorways, thick concrete walls to protect oil tanks, and oil tanks that store oil. I have focused on how to maintain and transform these changing factors to make visitors feel the passage of time. In this paper, this design methodology is largely divided into visual exposure, contrast of recognition, penetration due to walking, and features of each element are derived.

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## A Smart Floor Design for Korean Traditional Game using A Game Stone

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**Abstract:** In modern society, the demand of physical activity continues increasing, and indoor space construction methods using devices that apply the information and communication technology are introduced. The methods use walls or floors. The smart floor is an indoor space construction method on the floor, which provides the interaction between the floor and the human activity. In this paper, we propose a smart floor design for the Korean traditional Game Sabang-chigi using a game stone that displays LED (Light Emitting Diode) light as the information marker and IR (Infra-Red) cameras installed at the four edges on the smart floor space as the information detector from the game stone. The game stone provides some essential game play information, which is retrieved by the IR cameras. Hence, we can implement other body-experience games.

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## Road Detection by PDF-Based Classification

Cheng Deng<sup>1</sup>, Han Xie<sup>2</sup>, Yunfan Chen<sup>3</sup>, Hyunchul Shin<sup>4</sup>

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**Abstract:** Road detection is essential for road departure warning, autonomous driving, and supporting driver-assistance systems. The major challenge of vision-based road-detection techniques is to deal with illumination variations, especially extreme shadows and highlights. We propose an innovative method to obtain a road segmentation which is robust to extreme shadow and highlight conditions. The novelty of our approach is that we combine the shadow-invariant feature space with horizon estimation, tone mapping, and probability density function (PDF)-based classification, to achieve fast and accurate road region segmentation.



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## Fourier Transform near Infrared Spectroscopy for the Evaluation of the Salt Content in Canned Sardine in Oil

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**Abstract:** The salt content of canned sardines in oil was determined using Fourier transform near infrared (NIR) spectroscopy, and the results were compared to those obtained with an auto-titrator, which is a more time-consuming method that uses harsh chemicals. Partial least squares (PLS) regression models were obtained from 3 groups of samples, including salt-adjusted samples, non-salt-adjusted samples and salt-adjusted samples plus 5 non salt-adjusted samples. The model developed with salt-adjusted samples used first derivative + multiplicative scatter correction spectra between 9403.8 and 5446.3 cm<sup>-1</sup> with 7 PLS factors and provided a coefficient of determination (R<sup>2</sup>), root mean square error of prediction (RMSEP), bias, ratio of standard error of validation to the standard deviation (RPD) and ratio of performance to interquartile (RPIQ) of 0.996, 0.139%, -0.002%, 16 and 3.87, respectively. When the model was validated by unknown samples, it provided the lowest RMSEP and a bias of 0.13% and 0.0593%, respectively. The NIR spectroscopy protocol developed could be used for quality control purposes in factories producing canned sardines in oil.

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## Development of Smart Control Forklift using Center-of-Gravity Analysis of Small Forklift

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**Abstract:** In this study, structural analysis results of the forklift, an agricultural machine developed jointly by Catholic Kwandong University Biomedical Engineering Lab and Sungbu Industrial LTD. For the structural analysis of the forklift, we focused on the physical properties based on simulation and basic science based on solid works. We hope to contribute to agriculture society entering aging through structural analysis of forklift completed through research, and furthermore, contribution of agriculture industry and biomedical support based on such research.



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## New March Elements for Faults due to Open Defects in eSRAM

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**Abstract:** This paper presents a complete analysis on the ability of March tests to detect dynamic faults in embedded-SRAMs using open defects. Dynamic faults are hard to detect and are the primary cause of violation in normal operation of eSRAM. In this work, we show the failure of traditional March tests without modifications in detecting them. We propose SRAM fault model with open defects that cause dynamic faults. The proposed new March elements involve a particular sequence and data to be written. Compared to the previous March solutions, these new March elements ensure the fault observation. However, the complexity of March algorithms and increased test length restrict the use of them in applications where at speed test is essential. This paper suggests a solution to this problem using method of extraction of parasitic resistance and capacitance of a defect node.

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## Smart Business Continuity Management Framework for UAE

Al Hammadi<sup>1</sup>

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**Abstract:** Many organizations and companies all over the world are working to prepare and implement smart community business plans to make their business' operation run uninterruptedly after facing various outbreak incidents. Nowadays, Smart Business Continuity Management (SBCM) allows businesses to function in continuity and in a more optimized manner. Under SBCM, cities will be more secure, convenient and improved, adding significant value to the city. There have been sufficient studies done to find out what technologies must be considered to meet all the requirements of a secure city. Smart approaches can be applied in many areas such as monitoring of infrastructure, predicting or forecasting the disasters, robotics, ICT, and managing the structure of the city. This paper provides a SBCM framework which is developed by the Telecommunication Regulatory Authority (TRA) in United Arab Emirates (UAE). It also focuses in the idea of building smart and efficient projects in UAE by using the latest methods that have been established by experts in the field of SBCM.



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## IEO and Theory U in the Entrepreneurial Process

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**Abstract:** This research philosophises about the empirical relationship between IEO and Theory U as well as the correlation between its factors. Data was collected using a questionnaire completed during lectures by 380 university students in South Africa. It was found that when applying IEO and Theory U as a social technology, youth might be able to transform the way how they think and “do” entrepreneurship, through moving from reactive to generative response fields.

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## International Professional Development: Lessons Learned

Kania Greer<sup>1</sup>, Lisa Stueve<sup>2</sup>

**Abstract:** In 2016 Georgia Southern University Institute for Interdisciplinary STEM Education (i2STEMe) was approached by a collaborative group of educators from India now living in the US. They noticed a need for teachers in India to have access to the Interdisciplinary STEM Education pedagogical techniques through focused professional development. Over the course of the next two years, the partnership developed and in September 2016 the first group of educators in India was given a professional development opportunity around the concepts of Authentic Teaching, including place-based education, problem based learning, and project based learning. This paper will discuss the approach the educators delivering the professional development took, the barriers and successes to implementing professional development in a new cultural setting, and the next steps to be taken. It is hoped that this information will provide future providers of PD, who are working outside their country of residence, with insights and ideas on working with a culturally different and diverse educational setting.



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## Adaptive Modulation Scheme based K-NN in Wireless Communication System

Chang-Bin Ha<sup>1</sup>, Seung-Jin Choi<sup>2</sup>, Hyoung-Kyu Song<sup>3</sup>

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**Abstract:** In this paper, the adaptive modulation scheme based K-NN according to channel environment is proposed. The problem of the conventional adaptive modulation schemes is that the criterion for determining modulation scheme according to channel environment is not clear. The main idea of the proposed scheme is to define suitable features and training data for adaptive modulation. The simulation results show that the proposed scheme adaptively determines the optimal modulation scheme for BER and throughput performance according to channel environment.

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## OFDM Timing Offset Estimation Scheme Based on Correlation Function

Won-Chang Kim<sup>1</sup>, Chang-Bin Ha<sup>2</sup>, Hyoung-Kyu Song<sup>3</sup>

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**Abstract:** This paper proposes the timing offset estimation method using the training symbol in the orthogonal frequency division multiplexing (OFDM) system. The proposed timing synchronization method has similar mean square error (MSE) performance while using the training symbol that can be generated more easily than the conventional method. The simulation results show that the proposed method has higher than MSE performance than that of the conventional method by having the impulsive shaped timing metric.



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## Low Complexity MIMO Detector based on Adjustable Threshold

Seung-Jin Choi<sup>1</sup>, Won-Chang Kim<sup>2</sup>, Hyoung-Kyu Song<sup>3</sup>

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**Abstract:** In this paper, the novel adaptive detector based on the channel condition is proposed in the MIMO-OFDM systems. The adaptive detection performs switching detection method according to variation of the threshold based on the computational complexity required at the receiver side. The switching detection algorithm selects the two detection methods, i.e. the LR-aided MMSE, and QRD-M. From the simulation results, the proposed adaptive detector shows error performance and multiplication complexity according to the variation of the threshold for adaptive detection.

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# POSTERS







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## A Study on the Relationship between Hydrological Variables and Water Quality from Remotely Sensed Data

Jaehwan Jeong<sup>1</sup>, Jongjin Baik<sup>2</sup>, Peng Ying<sup>3</sup>, Minha Choi<sup>4</sup>  
<sup>1,2,4</sup>South Korea, <sup>3</sup>China

**Abstract:** Water-related issues have always been caught the attention scientific community and researchers across many disciplines around the globe. This is because water resources are directly linked to the food and energy necessary for human beings. The shortage of water can be described as not only a limited quantity of absolute water, but also a lack of usable water. Generally, the lack of water resources means a shortage of water available to humans, so water quality can also be an important issue. The water quality parameter observed at the point lacks in spatial representativeness, and collecting it frequently is not practical and economical. In order to circumvent the limitation of ground based measurements, satellite data has the advantage in capturing the spatial distribution of water quality parameters at large area. Despite limitations of point based measurements of water quality parameters, these are important datasets for validation of the remotely sensed parameters. Therefore, the objective of this study is to validate the water quality parameters using satellite data, and to compare the temporal variability of the satellite-based water quality data with the hydro-meteorological variables. This study can be used as a basis for further study to predict and prepare water quality change by analysing water quality fluctuation due to hydro-meteorological condition.



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## Effects of Sodium Sulfite as a Food Additive on Catalase and Glutathione-S-Transferase Enzyme Activities in Tubifex

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**Abstract:** Sodium sulfite is used to keep the food product with fresh appearance by food industry. In this study, the effects of sodium sulfite sublethal dose on aquatic oligochaeta *Tubifex tubifex* were investigated and enzyme activity changes of Catalase and Glutathione-S-Transferase were evaluated. The antioxidant enzyme activity changes were searched as a result of 2, 4 and 6 hour exposure within various concentrations (2.5mM, 5mM and 10mM) of sodium sulfite in *Tubifex tubifex*. Catalase and Glutathione-S-Transferase activity increased depending on the time when data were compared with the control groups.

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## High-Throughput Screening of Medical Herb Libraries to Identify Anti-Melanogenic Agents

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**Abstract:** Medical herb extracts acting as selective activator, inhibitors, or modulator of melanogenesis represent candidate cosmetic ingredient for pigment disorder, such as a hyperpigmentation diseases. The identification of melanogenesis regulator may be achieved by screening highly diverse synthetic or natural compound libraries using high-throughput methods. Thus, we identified seven medical herbs extracts screened against anti-melanogenic agent from selected libraries using high throughput melanin contents assay. Moreover, in vivo and in vitro evaluation, we revealed anti-melanogenic activity of Poria cocos Wolf extracts that is one of medical herbs screened by high throughput melanin contents assay. Through these results, we identified noble anti-melanogenic ingredient to be used in cosmetics.



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## Anticancer Effects of S32 are Associated with Mitochondria-Mediated Apoptosis in Human Cervical Carcinoma HELA Cells

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**Abstract:** In the present study, 1-[(3S, 4R) - 2, 2-dimethyl-3-oxo-4-(2-piperidonyl) chroman-6-yl]-3-phenylurea (S32) was synthesized and its anticancer activity was investigated on the in vitro growth of HeLa cells. We showed that IC50 value of S32 was about 70  $\mu$ M by using WST-8 assay and significantly inhibited the proliferation and viability of HeLa cells in dose-dependent manner after 48 h. The morphological changes of apoptotic cell exhibited cellular shrinkage and nuclear condensation. The results of [<sup>3</sup>H]-thymidine incorporation and flow cytometric analysis indicated that S32 induced inhibition of DNA replication and G2 phase cell cycle arrest. Moreover, S32 treatment increased reactive oxygen species (ROS) and decreased mitochondrial membrane potential in time-dependent manner. By Annexin V-FITC/PI dual staining assay, we found that S32 significantly increased early apoptosis of HeLa cells in time-dependent manner. Western blot analysis showed that this apoptotic induction was associated with an increase in levels of Bax, a decrease in levels of Bcl-2, which was followed by activation of caspase-8, -9 and -3. This finding suggested that S32 induced apoptosis through the mitochondria-mediated pathway.

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## MTJ Related Material ETCH Process using Inert Gas

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**Abstract:** As the volatile dynamic random access memory device faces a physical limitation, new memory devices are actively investigated to solve this problem. Among them, spin transfer torque magnetic random access memory has received a lot of attention because of its high speed of device, endurance, low power consumption of device, and high density memory cell in addition to the non-volatility of information. However, the etching of Nano scale magnetic tunnelling junction (MTJ) induces oxidation in magnetic layer, pattern degradation and damage, or sidewall re-deposition with the slanted etch slope of the patterned MTJ sidewall. These disadvantages should be improved to fabricate a reliable device. In this study, for successful etching of MTJ related materials, such as CoFeB, CoPt, MgO and a hard mask material such as W, ICP etching using Ar, He, and CO/NH<sub>3</sub> were conducted. When the MTJ materials were etched with inert gas, the gas induces smaller magnetic degradation. Also the etch selectivities and the etch profiles of the etched MTJ patterns were significantly improved. The etch mechanism on the etching of MTJ materials by the inert gas will be presented.



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## Evaluation of Plasma-Induced Charging Damage during Manufacturing Process of Sub-20nm DRAM

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**Abstract:** Plasma-Induced Damage (PID) is one of critical issues in designing and manufacturing Metal-Oxide-Semiconductor (MOSFETs), because PID is believed to enhance reliability degradation and the variability. Plasma-induced Charging Damage (PCD), one of the mechanisms of the PID, is induced by conduction current from plasma flowing into gate dielectric, resulting in the degradation of MOSFETs reliability. This study examines the effect of PCD on sub-20nm DRAM during manufacturing processes. PCD was investigated by observing threshold-voltage shift using test structure with antenna. And it was investigated n-channel, p-channel both. The test structures are designed for all processes after gate forming so that PCD may be measured step by step as the process progresses. And the test structures are designed to have antenna ratio (exposed antenna area/gate area) distribution for each process. By measuring this test structure, accumulation of charging damages could be found as the process progresses, and also the correlation between PCD and each antenna ratio could be analyzed. Through measurement results, it is confirmed that PCD affects device degradation in sub-20nm DRAM manufacturing process. Furthermore, not only dominant process which causes PCD was found but also the correlation between PCD and antenna ratio of the dominant process. It is believed that the result of this study can be used to optimize process conditions or set up antenna design rules for sub-20nm DRAM.

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## Effect of Sidewall Angle Induced by Gate ETCH for Triple Gate FinFET

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**Abstract:** Gate profile is critical to the performance and yield of logic devices as the device becomes more scaling. Some fabricated FinFET devices present unintended gate profile. Gate poly must be etched from Fin top to Fin bottom to make the triple gate. This process leads gate to have non-rectangular cross-section shapes in the corner where the Fin and gate cross due to fabrication process limitations. One of the most frequent shapes is the trapezoidal. This shape makes undesirable sidewall angle of gate, which can affect device characteristics. This study addresses the simulation result of device performance and defect analysis by sidewall angle. The device performance is calculated based on a 10nm FINFET device through 3-D numerical simulation. A set of devices of several inclination angles and Fin top profile by etch process time were simulated. Etch process time to change sidewall angle has Fin top loss as a side effect. Also the defect modelling is based on real defect failure analysis by TEM. In conclusion, AC performance was improved by more vertical sidewall angle slope through capacitance gain although some DC performance was lost because of Fin top loss. In addition, non-vertical sidewall angle could induce leakage path between gate and source/drain. The gate sidewall angle will strongly impact overall chip performance and yield as the device becomes more scaling, so it should be monitored and managed significantly.



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## Chemical Compositions and Electrical Properties of Nd<sub>2</sub>O<sub>3</sub> Thin Films Coated by Low Cost Effective Sol–Gel Process

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**Abstract:** In this study, of Nd<sub>2</sub>O<sub>3</sub> thin films produced by sol–gel dip coating method on Si-P(100) wafer. The thin film chemical compositions were studied by Fourier transform infrared spectroscopy (FTIR) and energy-dispersive x-ray spectroscopy (EDX). The thin film thickness was determined by cross section SEM image which was approximately 1 micrometre. The back and front ohmic contacts were deposited to analyze electrical characteristics of deposited thin films. Electrical characterizations of Al/Nd<sub>2</sub>O<sub>3</sub>/Al-P(Si) MOS capacitors were performed different frequency(C–V) and (G/ ω–V) . The results show that, interface state and series resistance are very important parameter that can affect electrical characteristics of the capacitor. The maximum values of Rs have been decreased with increasing voltage frequency. Moreover Dit values were calculated 3.66 x10<sup>12</sup>eV-1 cm-2 and 7.98 x10<sup>12</sup>eV-1 cm-2 for the 250 kHz and 1 MHz respectively. When the calculated values are compared with the literature, Al / Nd<sub>2</sub>O<sub>3</sub> / P (Si)/ Al MOS capacitors show a demanded isolation property for microelectronics.

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## Dynamic Characterization of Interfacial Degradation Mechanism in SN Plated CU Lead Bonding on AU Bump

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**Abstract:** Sn plated Cu lead bonding on Au bump is widely used in driver IC to form electrical contact between chip and PI film. Due to the complexity of process and bonding parameters, the formulation of failure mechanism and understanding interfacial material behaviors of bump joint are time-consuming but critical process for reliability perspectives. Various analysis techniques have been used to characterize the interfacial reaction in Sn-Cu lead bonding. In particular, in-situ transmission electron microscopy (TEM) allows direct observations of the dynamic properties on the atomic scale through imaging. In this paper, we implemented in-situ dynamic heating TEM analyses with increasing temperature from 130 °C to 250 °C for various time periods to compare the material reaction of Au/Sn and Cu/Sn diffusion at the Sn-Cu/Au bump joint. It is found that Sn diffuses out rapidly to Au bump region then tends to form voids at the bump corner which triggers crack propagation because of stress concentration. Further in-situ heating TEM analysis at Cu-Sn interface revealed that Kirkendall voids are formed at the interface between Cu<sub>6</sub>Sn<sub>5</sub> and Cu lead, also Cu<sub>6</sub>Sn<sub>5</sub> and Cu<sub>3</sub>Sn IMCs are gradually developed driven by Cu diffusion through the grain boundaries as temperature increased.



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## Extraction and Characterization of Cellulose Nanofiber and Low Molecular Weight Lignin from Un-Utilized Woody Waste

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**Abstract:** Recently, dwindling of fossil resources and progress of global warming related to the mass consumption of fossil resources makes it necessary to consider the development of biofuel and biomaterial production from renewable biomass. Biorefinery is a new manufacturing concept for converting renewable biomass to valuable fuels and products. In this work, for the development of total biorefinery process of un-utilized woody biomass, the efficient extraction and utilization of woody structural components was carried out using woody chopsticks waste as a sample and steam explosion as a pretreatment. The components of steam-exploded product was extracted and separated into water extract, acetone extract, and holocellulose. Water extract had a high catechin equivalent and the cured epoxy resin was synthesized from acetone extract as a raw material. Acetone soluble lignin was used as a sample for not only epoxidized lignin, i.e. lignin epoxy resin, but also a curing reagent of epoxidized lignin. The thermal characteristics of cured lignin epoxy resin was evaluated using a differential scanning calorimeter.

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## Implementation of Smart Home Network System based on CoAP/6LoWPAN in Mobile Internet Environment

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**Abstract:** Recently, as the Internet of Things (IoTs) technology has become a big issue, many researches have been carried out to link the IoTs with the home network system. However, existing Internet protocols are not suitable for a limited environment such as low power, low capacity, and low performance. Therefore, the IETF proposed the CoAP/6LoWPAN technology as a suitable protocol for interworking IoT devices in a limited environment. In this paper, a smart home network system is implemented to control and operate IoT devices using CoAP / 6LoWPAN in mobile environment. The performance of HTTP and CoAP such as data transmission time is analyzed. The implemented system consists of CoAP client, 6LoWPAN G/W, CoAP server, Proxy Server, and Sensor. The CoAP client operates in the Android and receives information such as temperature, humidity, air pressure, and brightness from sensors through the CoAP server. 6LoWPAN G/W operates on Raspberry pie and connects CoAP client with wifi and supports BLE communication with CoAP server. It also assigns IPv6 addresses to CoAP servers. CoAP Server communicates with sensors implemented in Arduino by Zigbee communication. Proxy Server converts HTTP into CoAP messages when a client wants to communicate with CoAP server through HTTP rather than CoAP. As a result of analyzing transmission time using CoAP and HTTP, CoAP is reduced by 28.7% compared to HTTP. This shows that the CoAP is more efficient than HTTP because it is simpler than HTTP and omits the process of TCP connection establishment and termination.

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